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EPIDEMIOLOGICAL INVESTIGATION OF BRUCELLOSIS IN ONE HUMPED CAMELS (*Camelus dromedarius)* IN LAKE CHAD AREA OF BORNO STATE, NIGERIA

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ABSTRACT

An epidemiological investigation of the one-humped camel (*Camelus dromedarius*) was carried out to determine the status of camel brucellosis in the Lake Chad area of Borno state. A total of five hundred and eleven (511) sera were collected from adult one-humped camels and tested by Rose Bengal Plate Test (RBPT) and Microtitre Serum Agglutination Test (MSAT). Sixty two (12.13 per cent) of this samples tested positive by both RBPT and MSAT, out of which 23(4.5 per cent) were male and 39 (7.6 per cent) were female camels. There was no statistically significant association between sex and reaction to either of the serological tests P>0.05; OR=0.388-1.161. Two hundred and fifty seven (257) of the 511 sera collected were from slaughtered camels from abattoir while the remaining two hundred and fifty four (254) were from range camels. Thirty eight (14.8 per cent) of the 257 camels slaughtered in the abattoir and 24 (9.4 per cent) of those in the range were positive by both RBPT and MSAT, respectively. The statistical association was also not significant (P>0.05). Ten (3.9 per cent) and 14 (5.5 per cent) males and females, respectively were positive by both RBPT and MSAT, out of the 254 samples collected from range herds in the Lake Chad area of Borno state. Thirteen (5.05 per cent) of the 144 males from the abattoir samples were positive while 25 (9.7 per cent) of the 113 female were positive by both RBPT and MSAT. There was statistically significant association between positive serological reactions in female camels slaughtered in abattoir and those in herds in the range (OR=1.514-6.202; P<0.05). The overall prevalence of brucellosis among camels in Borno state was 12.13 per cent.

Key words: Abattoir, brucellosis, camels, herds, lake Chad, Nigeria, range, serology

Brucellosis is a zoonotic infection, four species being recognised as causing problems: *Brucella abortus* (cattle and camels), *Brucella melitensis* (goats, sheep and camels), *Brucella suis* (pigs), and *Brucella canis* (dogs) (Corbel, 1997; ASM, 2004). Zoonotic diseases like brucellosis are not only of veterinary importance but also severely affect human health, contributing to morbidity and reduction of working capacity with concomitant loss of income (Smits and Cutler, 2004). Brucellosis has been reported from almost all countries in Africa (McDermott and Arimi, 2002; Refai, 2002). Although brucellosis has been or is closely being eradicated from a number of developed countries, it continues to be a major public and animal health problem in many regions of the world, particularly where livestock are a major source of food and income (FAO, 2003). Investigations and evidence of infection as well as frank outbreaks have been reported in cattle (Ajogi, 1997), sheep and goat (Bale *et al*, 1982; Ocholi *et al*, 2005), horse (Ocholi *et al*, 2004), sheep, goat and human beings (Brisibe *et al*, 1993; EC, 2001) and camels (Okoh, 1979; Adamu and Ajogi, 1999). In Maiduguri municipal abattoir alone 8, 453 camels were slaughtered in 2002 and this figure rose to 15, 477 camels in 2005 (MOA, 2005). The camel milk is sold and consumed alongside that of cattle (Adamu and Ajogi, 1999). Camel meat and milk is increasingly important as a source of protein for the human populace, this highlights the potential importance of brucellosis for public health and measures are suggested for a national brucellosis control (Kudi *et al*, 1997; Adamu and Ajogi, 1999).

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The camel's ability to survive and produce under harsh environmental conditions has made it possible to use marginal and desertified ecosystems; and over the centuries, the camel has been a symbol of stability for the pastoralists in the arid zones of the world (Abbas *et al*, 1992). Camels are also believed to be a reservoir for brucellosis (Ismaily *et al*, 1988). The one-humped camel (*Camelus dromedarius*) may serve as a potential source of *Brucella* infection to other livestock and human in Nigeria (Ajogi and Adamu, 1998). Risk factors for infection include: the handling of contaminated animal products such as unpasteurised milk, and milk products (including cow, goat and camel), meat ("Suya and Kilishi") (Bale, 1991), animal by-products and handling cultures of *Brucella* spp in laboratories (Ajogi and Adamu, 1998, Salari, 2002; FAO, 2003). Brucellosis can be diagnosed definitively by isolation and identification of the causative organism and a considerable number of serological tests have been developed and were modified in various ways to increase performance (Nielsen, 2002; OIE, 2004). The Rose Bengal plate test (RBPT) and serum agglutination test (SAT) are used routinely for survey work in Nigeria (Eze, 1977; Ocholi *et al,* 1993). Kudi *et al* (1997) and Musa *et al* (2008) used Microtitre serum agglutination test (MSAT) in diagnosis of brucellosis in camels in Nigeria and Sudan, respectively. The initial report on prevalence of brucellosis among camels in Nigeria was based on serological evidence by Okoh (1979), where a prevalence rate of 1 per cent was reported in slaughtered camels in Kano. Later a prevalence of 7.5 per cent was found among camels in Kano by MSAT (Kudi *et al*, 1997). According to Junaidu *et al* (2006) in study of sero-prevalence of brucellosis in camel slaughtered in Sokoto State abattoir of North-western Nigeria; out of the 329 blood samples screened over a period of 52 weeks, 37 (11.42 per cent) were positive. Adamu *et al* (1997) in studies on seroepidemiology of one-humped camel (*Camelus dromedarius*) brucellosis in three northern states have reported prevalence of 12.5 per cent, 18.6 per cent and 25.5 per cent in Kano, Kaduna and Borno States, respectively. Prevalence rate of 9.5 per cent (Zaria *et al,* 1990) and 1.8 per cent (Egbe-Nwiyi *et al* 1999) were reported in camels slaughtered in Maiduguri Borno state North-Eastern Nigeria.

Borno State, being a state having three international boundaries with Republics of Chad, Niger and Cameroun, and unlimited animal movement across national boundaries coupled with the dramatic increase in consumption of camel meat, milk and milk-products underscores the role of camels in the epidemiology of brucellosis. This research is designed to study the role of camels in the Lake Chad area, in the epidemiology of animal brucellosis in Borno state of Nigeria.

Materials and Methods

This research was conducted in Borno state which lies between latitude 10°N and 13°N and longitude 12° and 15°E. The state has an area of about 69, 436 km, is the largest state in the federation in terms of land mass (Nigeriaonline, 2007).

A cross sectional (prevalence) study (Thrusfield, 2002) was conducted. A total of five hundred and eleven (511) adult one-humped camels (*Camelus dromedarius*) were examined out of which two hundred and thirty three (233) were males. Two hundred and fifty seven (257) serum samples were collected from camels slaughtered at the abattoir from which 144 (28.2 per cent) were males and 113 (22.1 per cent) were females. Two hundred and fifty four (254) samples were collected from camel herds in the range located within the Lake Chad area, out of which 89 (17.4 per cent) were males while 165 (32.3 per cent) were female.

Blood (5 ml) was aseptically collected from jugular vein and sera samples were stored at 20^{o}C. Sera were examined for *Brucella* antibody by Rose Bengal Plate Test (RBPT) as described by OIE manual (2004) and Microtitre Serum Agglutination Test (MSAT) as described by Alton *et al* (1988). Sera samples greater than 30IU were considered positive.

Results

Out of the 511 camels examined, sixty two (12.13 per cent) samples tested positive by both RBPT and MSAT. Out of these 62 (12.13 per cent) tested positive to RBPT and MSAT 23(4.5 per cent) were male camels (OR=0.433-1.143) and 39 (7.6 per cent) were female camels (OR=0.338-1.161) which was not significant at P>0.05 (Table 1). While 38 (14.8 per cent) and 24 (9.4 per cent) for abattoir and range herds, respectively tested positive by both RBPT and MSAT which was also not significant at P>0.05; OR=0.966-2.863 (Table 2). Out of the 257 samples from abattoir 13 (5.05 per cent) males were positive (OR=0.328-1.872) while 25 (9.7 per cent) females were positive (1.514-6.202) by both RBPT and MSAT. Ten (3.9 per cent) and 14 (5.5 per cent) males (OR=0.580-3.213) and females (OR=0.626-1.262), respectively were positive by both RBPT and

Table 1. Sexspecific rose bengal plate test (RBPT) and microtitre serum agglutination test (MSAT) reactors for both abattoir and range samples.

Sex	Total Animal tested	RBPT (%)		MSAT (%)		Odds Ratio	95% CI on OR	
		Positive	Negative	Positive	Negative		Lower	Upper
Male	233	23(4.5)	210	23	210	0.704	0.433	1.143
Female	278	39(7.6)	239	39	239	0.671	0.338	1.161
Total	**511**	**62(12.13)**	**449**	**62**	**449**			

Table 2. Both rose bengal plate test (RBPT) and microtitre serum agglutination test (MSAT) reactor and source of camel serum samples.

Srological Reaction (RBPT/MSAT)	Source of Camel (%)		Total	Odds Ratio	95% CI on OR	
	Abattoir	Range			Lower	Upper
Positive	38 (14.8)	24 (9.4)	62	1.663	0.966	2.863
Negative	219	230	449	2.845	1.939	4.175
Total	**257**	**254**	**511**			

Table 3. Source of camel serum samples by serological test status and sex of camel.

Sex of camel	Source of camel serum sample	Serological Test status (RBPT/MSAT)		Total	Chi Square	P-Value	Odds Ratio (OR)	95% CI on OR	
		Test Positive	Test Negative					Low	High
Male	Abattoir	13 (5.05%)	131	144	0.301	0.583	0.784	0.328	1.872
	Range herds	10 (3.9%)	79	89	0.511	0.475	1.365	0.580	3.213
	Total	**23 (9.8%)**	**210**	**233**					
Female	Abattoir	25 (9.7%)	88	113	10.345	0.001	3.064	1.514	6.202
	Range herds	14 (5.5%)	151	165	0.511	0.475	0.889	0.626	1.262
	Total	**39 (14.0%)**	**239**	**278**					

MSAT, out of the 254 samples collected from range herds. There was statistically significant association between females camels slaughtered in abattoir and positive serological reaction (OR=1.514-6.202; P<0.05) (Table 3). All samples tested positive to RBPT also tested positive to MSAT, except one (1) female sample among the abattoir samples that tested negative to RBPT gave positive test to MSAT. While one sample (female) from abattoir that tested negative to MSAT gave positive to RBPT. Overall prevalence of brucellosis among one-humped camels in this study was 12.1 per cent.

Discussion

Brucellosis of livestock was considered the most widespread zoonosis in the world (FAO/WHO, 1986). Camels are not known to be primary hosts of *Brucella* organisms, but they are susceptible to both *B. abortus* and *B. melitensis* (Cooper, 1992; Abbas and Agab, 2002). Consequently, infection rate in camels depends upon the infection rate in primary hosts animals in contact with them during grazing and watering points. They also appear to be potential source of infection to other animals (Ajogi and Adamu, 1998). Overall prevalence rate of 12.13 per cent was found from 511 camels in this study and this agrees with the finding of Al-Majali *et al* (2007) who reported 12.1 per cent from prevalence 412 camels from 7 herds in Jordan. The prevalence in this study was relatively higher than that reported in Egypt (11.6 per cent, Ahmed and Nada, 1993), Saudi Arabia (8 per cent, Radwan *et al*, 1995), Libya (4.1 per cent, Gameel *et al*, 1993), and Iran (8 per cent, Zowghi and Ebadi, 1988). In the study of field outbreak of brucellosis in camels in Sudan Musa *et al* (2008) reported prevalence of 28.3 per cent. These findings are higher than our findings because the study in Sudan was done on field outbreak. Likewise, the prevalence was also lower than that reported in Kuwait (14.8 per cent, Al Khalaf and El Khaladi, 1989) and Kenya (14 per cent, Waghela *et al*, 1978). The differences in these findings and ours could be due to difference in sample size and source of camel serum samples; because the present study involves sampling both from camels slaughtered in abattoir and those in the rage herds located in the Lake Chad area.

In Nigeria, the overall prevalence of 12.13 per cent in this study was lower than that found by Adamu *et al* (1997) who reported the prevalence rate of 25.5 per cent out of 432 slaughtered camels in Borno state. This could be due to the fact that this study was not only abattoir based, it involves camels in the range. The prevalence in this study was higher than that found by Okoh (1979), in Kano, and by Kudi *et al* (1997) in the same area. This could be due to, among other things, the larger sample size and distribution of the sample source. Zaria *et al* (1990) in an abattoir based sero-prevalence of camel brucellosis in Maiduguri and Egbe-Nwiyi *et al* (1999) in semi-arid zone of North Eastern Nigeria, reported 9.5 per cent and 1.8 per cent prevalence by both RBPT and SAT, respectively. This was lower compared to what was obtained in this study. This could also be due to low sample size of only 21 and 200 camels slaughtered in abattoir were sampled in the study of former and latter, respectively, as compared to 511 samples collected both from abattoir and camel herds in range. In a similar abattoir based study in Sokoto, Junaidu *et al* (2006) found a prevalence rate of 11.42 per cent in Sokoto this was slightly similar to our finding in this study.

In this study, there are more positive serological reactors among female (7.63 per cent) than male (4.5 per cent) camels. These findings are in agreement with the works of Egbe-Nwiyi *et al* (1999) who reported that out of 38 serologically positive camels 71.4 per cent were females while 28.6 per cent were males and Kudi *et al* (1997) who reported prevalence of 7.5 per cent among male and 8.3 per cent among female camels. A relatively similar result was reported by Junaidu *et al* (2006) 19 (10.10 per cent) out of 188 females and 18 (12.78 per cent) out of 141 male were serologically positive.

There are more serologically positive camels in the abattoir (14.8 per cent) than among those in the range (9.4 per cent). This could occur as a result of the fact that pastoralists usually cull female camels that are infertile or repeat breeders and males for slaughter. This was in agreement with Eberlein (2007) who reported that usually males and infertile female camels are sold as slaughter animals by pastoralists. One abattoir sample (female) that tested negative to MSAT gave positive to RBPT this could be as a result of high analytical sensitivity of RBPT as described by Nielsen *et al* (1984), OIE manual (2004) and Wright and Nielsen (1990). Likewise one abattoir sample that tested positive to MSAT gave negative to RBPT which is ascribed to the fact that RBPT and MSAT detects different immunoglobulins (Ig); MSAT detects IgM which is the most active agglutinin at a neutral or slightly below neutral pH (Nielsen *et al,* 1984). RBPT detects IgG_1 because it is used at pH of 3.65, the low pH prevents some agglutination by IgM and encourages agglutination by IgG_1 as described by Nielsen (2002); OIE manual (2004) and WHO (2006).

Conclusions

The overall sero-prevalence of camel brucellosis in Borno state was 12.13 per cent by both Rose Bengal Plate Test (RBPT) and Microtitre Serum Agglutination Test (MSAT). The sero-prevalence was higher among female camels 39 (7.6 per cent) than male camels 23 (4.5 per cent). Likewise the sero-prevalence was higher among camels slaughtered in abattoir 38 (14.8 per cent) than those in the range herds around the Lake Chad area 24 (9.4 per cent). There was statistically significant association between females camels slaughtered in abattoir and positive serological test than those in herds in the range (OR=1.514-6.202; $P<0.05$). No statistically significant association was established between sex and reaction to any of the serological tests (both RBPT and MAT).

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Antiserum production in immunised camel by the venom of *Hemiscorpiuslepturus* scorpion: evaluation of neutralizing test *in vivo*

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Scorpion envenomation is considered as one of the Public Health problems in some countries in the world including Iran. Annually, approximately 30,000 scorpion stings happen in Iran from which 12% belongs to *Hemiscorpiuslepturus* (special small closely spaced, bead-shaped jointed tail, similar in the shape to a cows tail, and is locally called ''gaodim'' (Gao, cow; dim, tail)) with 95% mortality. The main treatment is antiserum therapy which is produced in horse and is the only way to neutralise the venom. Due to the anaphylactic shock of the horse antiserum in some of the stung patients other source of antiserum is recommended. In this study, the ability of produce camel antiserum in neutralising the scorpion venom of *Hemiscorpiuslepturus* was performed in Balb/c model. Camel is an animal model that genetically is compatible with human genome, utilised in this research to produce antiserum against scorpion venom. Two camels were used for immunisation with the venom of *Hemiscorpiuslepturus*. ELISA method was used to confirm the immunity. Antiserum was produced and used for neutralizing test. The precipitated antiserum with saturated ammonium sulfate (SAS) was also used to perform the neutralising test in mice.The results indicated that the amount of 200 µl of antiserum and 400 µl of SAS antiserum were able to neutralise the amount of 1 LD100 of the venom and the survived the mice from death. The result indicated that camel antiserum against scorpion venom is capable to neutralise the crude venom in mice model. Due to the safety of camel serum in human, it is suggested that the produced antiserum in camel can be substitute with the traditional horse antiserum in scorpion stung patients.

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